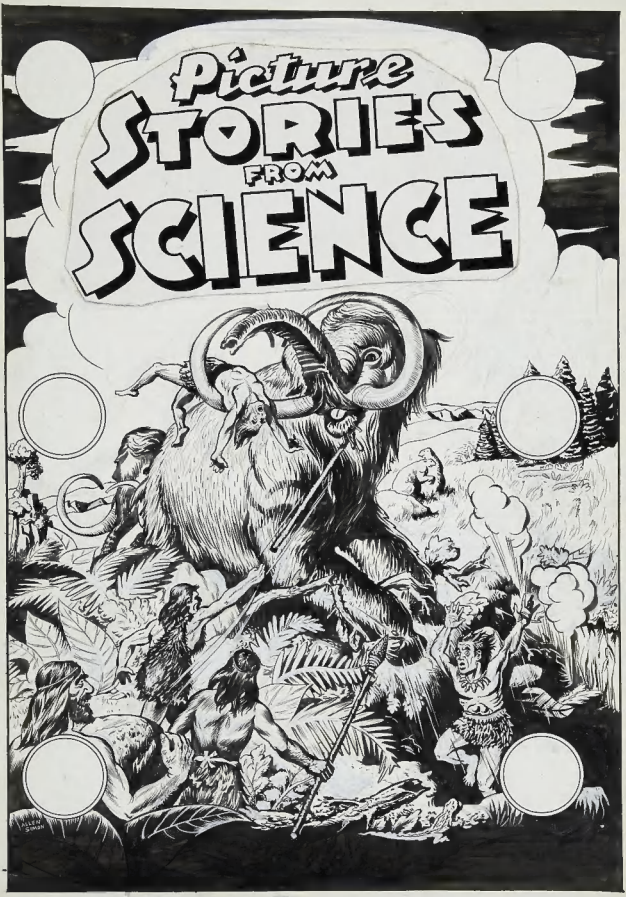

Picture
STORIES
FROM
SCIENCE

NEW LIFE FOR OLD

The Story of Life's Beginning

OUR SPINNING EARTH THROBS AND TEEMS WITH LIFE!! ITS MAGIC FILLS THE SEAS, COVERS THE LAND, AND FLIES IN THE AIR ABOVE US. FROM THE FAST-FROZEN TUNDRAS OF THE NORTH---TO THE SUN-SEARED DESERTS OF THE TROPICS, THE SPARK OF LIFE APPEARS EVERYWHERE...IN COUNTLESS FORMS BOTH IN PLANTS AND ANIMALS. BUT HOW IS THIS VITAL SPARK KINDLED?? WHERE DOES IT ORIGINATE ??

CENTURIES AGO, PEOPLE HAD STRANGE IDEAS ABOUT WHERE LIFE CAME FROM...

Father, what is the name of those hard-shelled sea animals growing on that rock?

They are called "barnacles" They grow out of rocks and later turn into *geese!*

EVEN A BELGIAN SCIENTIST, VAN HELMONT, PRESCRIBED THIS PECULIAR FORMULA ABOUT 300 YEARS AGO...

Van Helmont says, "place a linen rag with some grains of corn in a dark place, and in 21 into a *mouse!*

THIS FANTASTIC NOTION THAT NEW LIVING THINGS JUST "HAPPEN" OUT OF DEAD STUFF IS KNOWN AS THE THEORY OF *SPONTANEOUS GENERATION*. PEOPLE EVERWHERE ACCEPTED IT.

EEOW ! This field is full of bees!

Sure ! They grow out of the dead body of that young bull !

BUT HERE AND THERE WERE MEN WHO REFUSED TO BELIEVE IN SUCH MIRACLES. FRANCESCO REDI (1626-1697), AN ITALIAN DOCTOR, WAS ONE...

What is your opinion of spontaneous generation, Francesco?

I'm not sure that I believe in it ! Those maggots crawling in that spoiled meat puzzle me...

But everyone knows that maggots arise from dead, decaying meat!

Perhaps! Yet I've noticed that *flies* are usually seen about such meat. Perhaps they have something to do with those maggots!

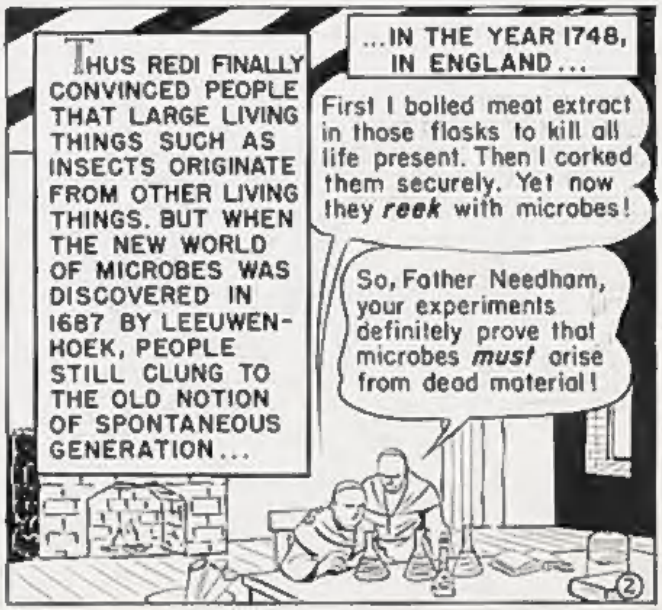
AND SO—IN 1668—REDI TRIED AN EXPERIMENT. FIRST, HE PUT SOME MEAT IN THREE DIFFERENT JARS...
We'll leave one jar uncovered. But we'll cover the second jar with parchment and the third with fine gauze! Then we'll wait for results...

AND SEVERAL DAYS LATER...
Look, Redi! The meat spoiled in all three jars— But *only in the open jar* is the meat crawling with maggots and flies!
Yes! The interiors of the two covered jars are completely free of the maggots and flies!

That's odd! There are maggots hatching from eggs on top of the gauze cover, but none on the parchment cover...
Just as I suspected!

Flies, attracted by the odor of decay, lay eggs in meat. The gauze screens them from the meat, so they lay their eggs on the gauze!
And as the parchment keeps the odor from escaping, flies aren't attracted to this jar!

Correct! Maggots do not originate in spoiled meat! They only *hatch* there from flies' eggs and later develop into other flies. Life does not arise spontaneously! *Life comes from pre-existing life!*


THUS REDI FINALLY CONVINCED PEOPLE THAT LARGE LIVING THINGS SUCH AS INSECTS ORIGINATE FROM OTHER LIVING THINGS. BUT WHEN THE NEW WORLD OF MICROBES WAS DISCOVERED IN 1687 BY LEEUWENHOEK, PEOPLE STILL CLUNG TO THE OLD NOTION OF SPONTANEOUS GENERATION...
...IN THE YEAR 1748, IN ENGLAND...
First I boiled meat extract in those flasks to kill all life present. Then I corked them securely. Yet now they *reek* with microbes!
So, Father Needham, your experiments definitely prove that microbes *must* arise from dead material!
2

BUT THE ABBE SPALLANZANI (1729–1799), AN ITALIAN SCIENTIST, SUSPECTED THAT FATHER NEEDHAM HAD NOT BEEN VERY CAREFUL IN HIS EXPERIMENTS...

Germs in the air might have entered his flasks before he could close them. I'll repeat his experiment but will seal the flask with heat while it is still in the flame!

SURE ENOUGH---NO MICROBES APPEARED! AND SO, ONCE AGAIN, THE IDEA OF SPONTANEOUS GENERATION WAS LAID LOW. BUT NOT FOR LONG...FOR IN 1859, IN FRANCE, A BITTER DEBATE BROKE OUT BETWEEN TWO GREAT SCIENTISTS...FELIX POUCHET AND LOUIS PASTEUR!

FELIX POUCHET (1850-1872)

LOUIS PASTEUR (1822-1895)

This bottle, turned upside down in mercury, is filled with boiling water!

And, Dr. Pouchet, the *pure* oxygen passing through this tube will displace some of that water!

Now, with these sterilized forceps, I'll thrust this heat-sterilized hay through the mercury into the bottle...

In other words, it will float on germ-free water, surrounded by germ-free oxygen, in a germ-free bottle sealed off by mercury!

YET, TO THEIR COMPLETE AMAZEMENT...IN A SHORT TIME...AND IN SPITE OF ALL THESE PRECAUTIONS...

There's our proof! The previously lifeless hay now swarms with microbes!

You're right! Living things *do* arise spontaneously... Spallanzani was wrong!

BUT LOUIS PASTEUR, THE GREAT FRENCH SCIENTIST, STRONGLY DISAGREED..

Dead things cannot give birth to life! Germs entered Pouchet's bottle from the outside—probably with *dust*, which is always alive with microbes...

POUCHET WAS ENRAGED AT THE CRITICISM...AND THE DEBATE BETWEEN THE TWO MEN GREW SO VIOLENT THAT THE ACADEMY OF SCIENCES APPOINTED A COMMISSION TO EXAMINE ALL THE EVIDENCE. FINALLY, IN 1864, A DATE WAS SET FOR A VAST DEMONSTRATION. PUBLIC INTEREST RODE HIGH...

IN A DARKENED ROOM AT THE SORBONNE, PASTEUR PRESENTED HIS VIEWS...

Let's use this strong light to examine Pouchet's apparatus. See how the mercury's surface is covered with dust, when Pouchet thrust his forceps through the mercury....

....Those dust particles clung to it and contaminated the contents of the bottle! The living germs in the dust later multiplied in the bottle!

Pasteur is right! *Life comes only from life!*

CONVINCED BY PASTEUR'S DEMONSTRATIONS, AND ANNOYED BY POUCHET'S REFUSAL TO EXPERIMENT FURTHER, THE COMMISSION DECIDED IN FAVOR OF PASTEUR...

Down with Pouchet!

No more spontaneous generation!

THEN, IN 1876, AN ENGLISH SCIENTIST NAMED JOHN TYNDALL (1820–1893), SET UP A NEW TYPE OF APPARATUS THAT DEFINITELY DISPROVED SPONTANEOUS GENERATION...

The top 2 coiled tubes filter out dust from air that enters this windowed-box. When this light shows the complete absence of dust, I pour foods through the funnel into test tubes below!

Won't the foods spoil and develop microbes?

No! These foods were heated beforehand to kill any life in them, and they remain fresh and free of microbes *indefinitely*. Only on exposure to *dusty* air do microbes appear!

You have proved Pasteur was right! Germs in food come from germs in the *air. All life comes from life!*

BUT WHERE DID THE *FIRST* LIFE COME FROM? POSSIBLY WHEN THE EARTH WAS YOUNG, CERTAIN ELEMENTS COMBINED UNDER UNUSUAL CONDITIONS TO FORM SIMPLE ONE-CELLED PLANTS FROM WHICH ALL PLANTS AND ANIMALS EVOLVED. THE NEXT STORY TELLS ABOUT THE MYSTERIES OF THESE CELLS AND THE LIVING SUBSTANCE IN THEM...

NATURES BUILDING BLOCKS

AMOEBA

The Story of Cells and Protoplasm

PALISADE CELLS FROM LEAF

DO YOU KNOW THAT PEOPLE MAKE UP ONLY A VERY SMALL PART OF THE WORLD'S POPULATION? WHY IS THIS SO? BECAUSE THE WATERS, THE EARTH AND THE AIR LITERALLY *TEEM* WITH PLANT AND ANIMAL LIFE!

AND THOUGH MAN IS SMALLER THAN MANY AND BIGGER THAN MOST—YOU WILL SEE THAT *ALL* LIVING THINGS—WHATEVER THEIR SIZE OR STRENGTH—ARE ALIKE IN MANY WAYS....

ALL LIVING THINGS ARE COMPOSED OF TINY BUILDING BLOCKS CALLED *CELLS*—FIRST DISCERNED AND NAMED IN 1665 BY AN ENGLISH SCIENTIST, ROBERT HOOKE (1635-1703)...

When magnified, cork resembles the cells of a honey-comb, so I'll call those compartments—*cells!* Just look at them!

AND THIS IS WHAT ROBERT HOOKE SAW UNDER THE MICROSCOPE...

NOW HOOKE HAD SEEN ONLY THE CELL WALL AFTER THE LIVING MATTER HAD DISAPPEARED. BUT IN 1831, ROBERT BROWN (1773-1858), A SCOTCH ARMY SURGEON, SAW A LOT MORE...

In every plant cell there is a round, dark area. I don't know its function, but I'll call it the *nucleus!*

IT WAS BROWN'S DISCOVERY OF THE NUCLEUS—THE "HEART AND BRAIN" OF THE CELL—THAT INTERESTED MATTHIAS SCHLEIDEN, A GERMAN SCIENTIST...AND, A LITTLE LATER HIS CLOSE SCIENTIST-FRIEND, THEODOR SCHWANN...

MATTHIAS SCHLEIDEN (1804-1881)

THEODOR SCHWANN (1810-1882)

IT BEGAN ONE DAY IN OCTOBER, 1838, AS THE TWO MEN WERE HAVING DINNER...

I tell you, Theodor, there is a nucleus in all plant cells that seems to control the growth of old cells and the formation of new ones!

Now there's a coincidence! I've been experimenting with *animal* cells, and—well come along and see for yourself!

A FEW MINUTES LATER, IN SCHWANN'S LABORATORY...

You're right! There is a nucleus in your animal cells similar to that in my plant cells!

That gives me a hunch! It may be that plant and animal cells are structurally alike!

AFTER MONTHS OF HARD WORK, SCHWANN ANNOUNCED HIS REVOLUTIONARY CELL-THEORY...A MILESTONE IN THE HISTORY OF SCIENCE!

Schleiden and I have found that *all* plants and animals are made up of practically identical building blocks or cells which look and act alike!

BUT WHAT WERE THOSE CELLS MADE OF? IN 1835, EVEN BEFORE THE CELL-THEORY WAS ANNOUNCED, A FRENCH SCIENTIST, FELIX DUJARDIN (1801-1860), MADE A STUDY OF THE STUFF IN ANIMAL CELLS, AND...

What's in those animal cells, Dujardin?

They're made up of a part-liquid, jelly-like substance which seems to be *alive*...

AND IN 1846, HUGO VON MOHL (1805-1872), A GERMAN SCIENTIST, ANNOUNCED...

There is also a living, jelly-like substance in *plant* cells! The bohemian scientist, Purkinje, has suggested that we call it "protoplasm"!

AND THAT GAVE RISE TO A NEW QUESTION: "IS THE STUFF DUJARDIN SAW IN ANIMAL CELLS AND THE STUFF VON MOHL SAW IN PLANT CELLS THE *SAME*?"

MAX SCHULTZE (1825-1874), A GERMAN SCIENTIST...

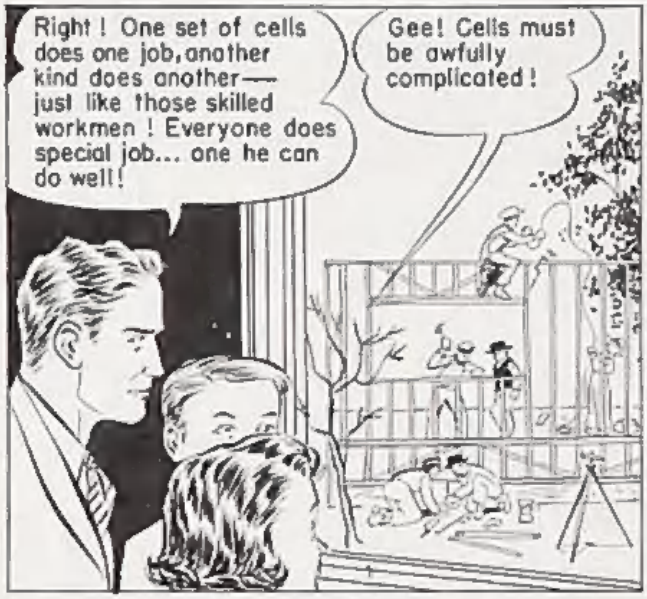
...WAS ABLE TO GIVE THE ANSWER IN 1861, AFTER YEARS OF RESEARCH...

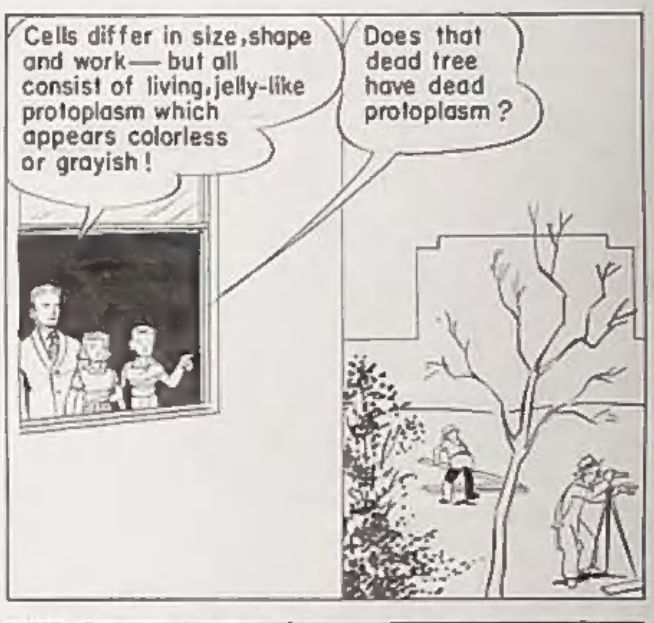
Protoplasm is the living substance which surrounds the nucleus of *all* cells and is practically *identical* in both plants and animals!

SCHULTZE'S DISCOVERY EARNED FOR HIM THE TITLE—FATHER OF MODERN BIOLOGY—BECAUSE BIOLOGY SINCE THEN HAS BEEN BASED CHIEFLY ON A KNOWLEDGE OF CELLS AND PROTOPLASM. BUT LET'S GO INTO THE SCIENCE ROOM NOW AND LEARN MORE ABOUT THEM FROM MR. LEEDS, TOMMY'S TEACHER...

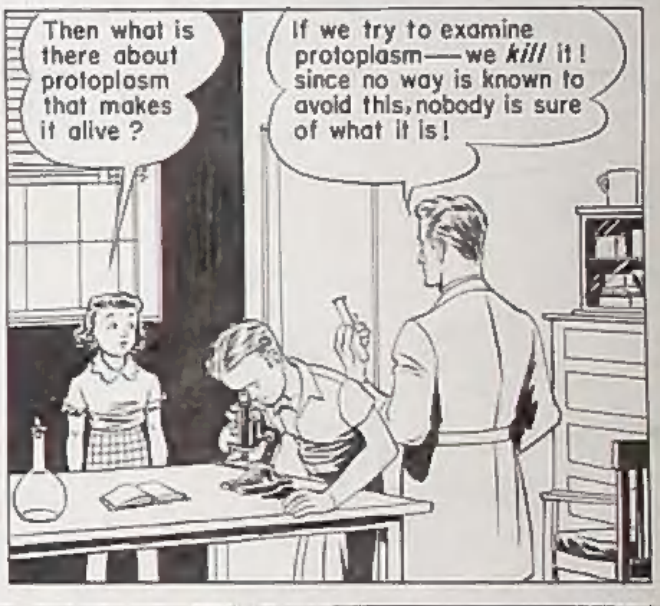
SCIENCE ROOM

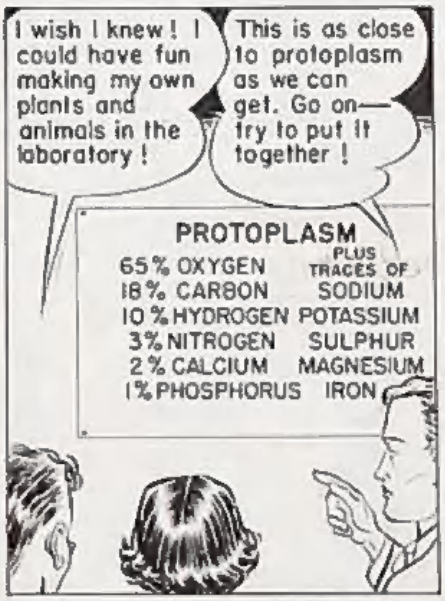
To begin with—almost all cells are too small to be seen without a microscope. Most plants and animals consist of billions of single cells of many shapes, linked together.
Are there big cells too ?
Yes... such as the eggs of some animals. This hen's egg, for example, is just a single, large cell.
Wow ! What makes it so big ?
It contains lots of stored food that we call the "yolk". The living part of the cell is in a tiny spot on the yolk's surface !
I suppose the bigger the animal or plant — the more cells it has....
True ! And then there are tiny living beings like this *amoeba* whose body consists of *one* cell !
AMOEBA
But how can it live with only a single cell ?
Its cell is a jack-of-all-trades! It takes up food, digests it and uses it to build up its own body, and also eliminates the wastes....
Also—it absorbs oxygen, grows, reproduces, moves about, avoids dangers, in short—it is very much alive !
Gee ! That cell's a genius—it can do *everything !*
AMOEBA
On the other hand, cells of higher plants and animals.... like trees and people.... are experienced specialists....
You mean that those cells *don't* have to be expert in everything ?
ANIMAL CELLS
CELLS FROM FROG'S SKIN
NERVE CELL
MUSCLE CELLS
PLANT CELLS
CELL WALL
CELL SAP
NUCLEI
PITH CELLS FROM STEM
PALISADE CELLS FROM LEAF
NUCLEI
ROOT HAIR
ROOT CELLS
3

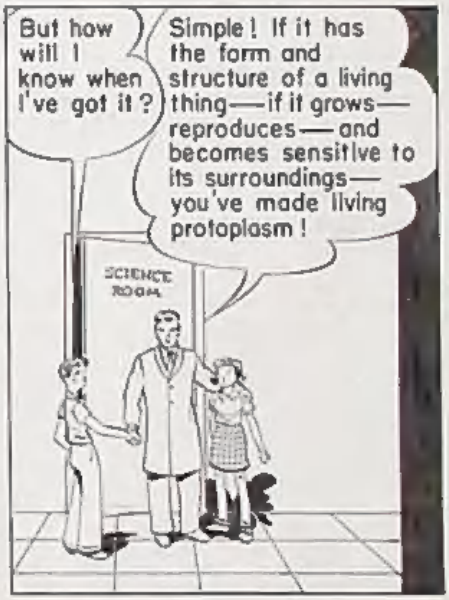

Right ! One set of cells does one job, another kind does another— just like those skilled workmen ! Everyone does special job... one he can do well!
Gee! Cells must be awfully complicated !

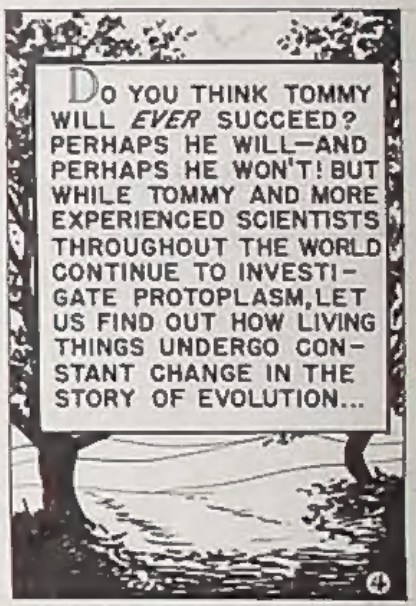

Cells differ in size, shape and work— but all consist of living, jelly-like protoplasm which appears colorless or grayish !
Does that dead tree have dead protoplasm ?

No! Protoplasm may *produce* things that aren't alive, like the bark of that tree or your hair and nails, but those growths aren't protoplasm. When protoplasm dies, it changes into something other than protoplasm !


Then what is there about protoplasm that makes it alive ?
If we try to examine protoplasm— we *kill* it ! since no way is known to avoid this, nobody is sure of what it is !


I wish I knew ! I could have fun making my own plants and animals in the laboratory !
This is as close to protoplasm as we can get. Go on— try to put it together !
PROTOPLASM
65% OXYGEN
18% CARBON
10% HYDROGEN
3% NITROGEN
2% CALCIUM
1% PHOSPHORUS
PLUS TRACES OF
SODIUM
POTASSIUM
SULPHUR
MAGNESIUM
IRON


But how will I know when I've got it ?
Simple ! If it has the form and structure of a living thing— if it grows— reproduces— and becomes sensitive to its surroundings— you've made living protoplasm !
SCIENCE ROOM


DO YOU THINK TOMMY WILL *EVER* SUCCEED? PERHAPS HE WILL—AND PERHAPS HE WON'T! BUT WHILE TOMMY AND MORE EXPERIENCED SCIENTISTS THROUGHOUT THE WORLD CONTINUE TO INVESTIGATE PROTOPLASM, LET US FIND OUT HOW LIVING THINGS UNDERGO CONSTANT CHANGE IN THE STORY OF EVOLUTION...
4

THE NEXT GENERATION

The Story of Heredity

YELLOW PEAS

GREEN PEAS

WHY DON'T *DOGS* HAVE *KITTENS*, AND *CATS* HAVE *PUPPIES?* WHY WON'T AN APPLE SEED GROW INTO A HEN, OR A HEN'S EGG INTO AN APPLE TREE? IMAGINE HOW DIFFERENT THE WORLD WOULD BE IF THESE THINGS WERE POSSIBLE! HOWEVER, AS YOU KNOW, EACH LIVING THING ALWAYS REPRODUCES *ONLY ITS OWN KIND!* WHY IS THIS SO? THE ANSWER IS... *HEREDITY!*

OFTEN THE OFFSPRING OF LIVING THINGS CLOSELY RESEMBLES ITS PARENTS...

Helen is getting to look more like you every day!

Yes—but she's going to have her father's eyes!

OFTEN THE OFFSPRING OF LIVING THINGS DIFFERS WIDELY FROM ITS PARENTS...

This is Blackie. He's the black sheep of this family!

Funny! All the other pups are *white!* Why?

FOR CENTURIES NO ONE KNEW "WHY." THE REASONS BEHIND RESEMBLANCES AND DIFFERENCES BETWEEN PARENT AND OFFSPRING LAY ROOTED IN DEEP MYSTERY .....

My idea is that children are a blend of the characteristics of their parents!

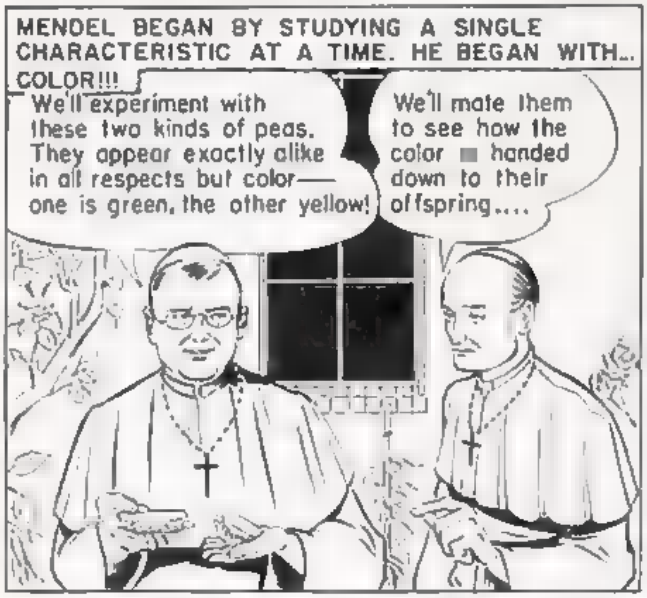
Sure! And wide differences are a "throw-back" from much earlier ancestors!

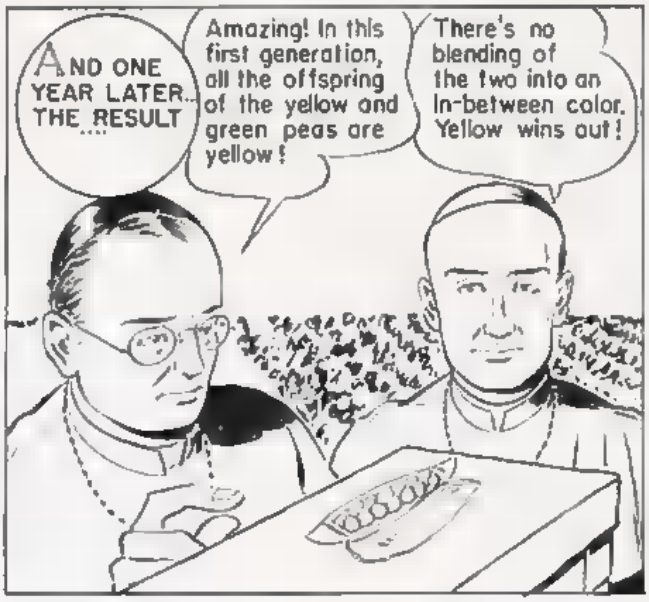
BUT WHILE THIS GUESSING WAS GOING ON, A SIMPLE MAN, RAISING PEAS IN A TINY GARDEN IN AUSTRIA, DISCOVERED FACTS ABOUT THOSE PLANTS WHICH LAID THE BASIS OF THE SCIENCE OF HEREDITY. THE MAN WAS ABBOT OF A MONASTERY IN BRÜNN. HIS NAME WAS... GREGOR MENDEL...

...GREGOR MENDEL (1822-1884)...

All this talk about inheritance is very vague! I'll go to nature for my facts and experiment!

I'll help you, Brother Gregor!

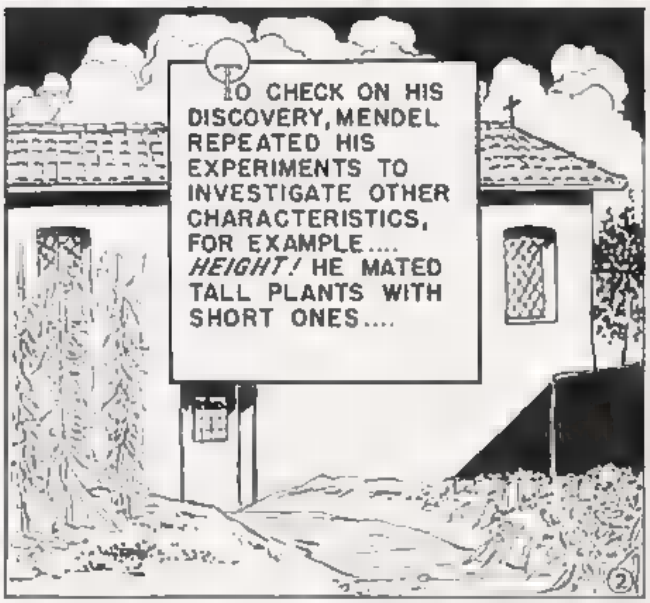

MENDEL BEGAN BY STUDYING A SINGLE CHARACTERISTIC AT A TIME. HE BEGAN WITH... COLOR!!!
We'll experiment with these two kinds of peas. They appear exactly alike in all respects but color— one is green, the other yellow!
We'll mate them to see how the color ■ handed down to their offspring....


AND ONE YEAR LATER... THE RESULT....
Amazing! In this first generation, all the offspring of the yellow and green peas are yellow!
There's no blending of the two into an in-between color. Yellow wins out!

Then we'll call yellow the dominant character!
That's a good name for ■ because it completely dominates and conceals the green. What now, Gregor?

Now we'll mate these new yellow peas with EACH OTHER!
And we'll see what their offspring looks like, eh?

AND AGAIN... THE RESULTS WERE STARTLING!
Look! In this second generation there are some GREEN peas! The green is a hidden character— why not call it "recessive"?
Yes! And there are three yellow to one green! Could this ratio of three dominant to one recessive be constant?


TO CHECK ON HIS DISCOVERY, MENDEL REPEATED HIS EXPERIMENTS TO INVESTIGATE OTHER CHARACTERISTICS, FOR EXAMPLE.... *HEIGHT!* HE MATED TALL PLANTS WITH SHORT ONES....
2

In the first generation, the plants are all tall! None of them are on average height—like yellow, TALLNESS is a DOMINANT character! SHORTNESS, like green, is a RECESSIVE character!

But the protoplasm of these new tall plants must be different from the parent's because these were built up in part of the protoplasm of a SHORT parent, too— thus....

... The plant having descended from a tall and short parent, its protoplasm MUST CONTAIN BOTH THE DOMINANT TALL CHARACTER and the recessive short character. We'll call a combination of dominant and recessive— a hybrid!

AND AFTER MATING HYBRID WITH HYBRID...

The offspring of hybrids resembles the grandparents! Some are tall— Some are short!

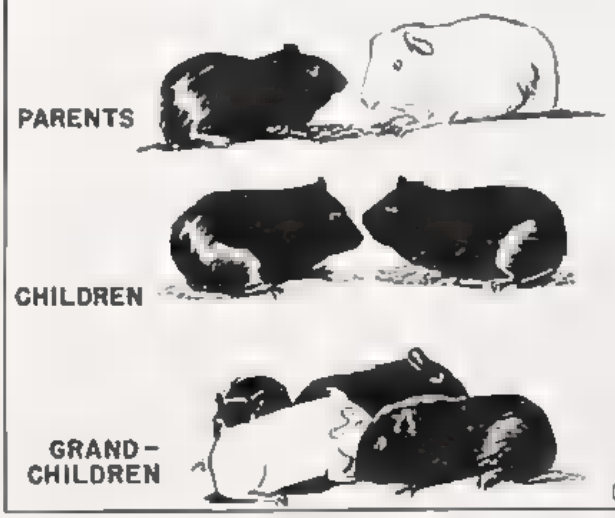
But ALWAYS in the ratio of 3 tall to 1 short— 3 DOMINANT TO 1 RECESSIVE!

THIS MATHEMATICAL LAW— 3 DOMINANT TO 1 RECESSIVE— WHICH, ACCORDING TO MENDEL, GOVERNS THE INHERITANCE OF COLOR AND SIZE IN PEAS, DOES NOT CONCERN PEAS ALONE. TODAY WE KNOW IT REFERS TO ALMOST EVERY CHARACTERISTIC OF PLANTS, ANIMALS AND MAN. ALL LIVING MATTER MUST OBEY THIS UNIVERSAL LAW OF HEREDITY...

...FOR EXAMPLE, HERE IS A SIMPLE CHART THAT SHOWS HOW MENDEL'S LAW APPLIES TO THE ANIMAL KINGDOM....

ANIMAL	DOMINANT	RECESSIVE
GUINEA-PIGS	COAT UNSPOTTED	COAT SPOTTED
	COAT BLACK	COAT WHITE
	EYES DARK	EYES PINK
	HAIR SHORT	HAIR LONG
	COAT ROUGH	COAT SMOOTH
HOGS	WHITE	COLORED
CATTLE	BLACK	WHITE
	HORNLESS	HORNED
HORSES	BAY IN COLOR	BLACK OR CHESTNUT
	TROTTING	PACING
CATS	BLACK	BLUE
	HAIR SHORT	HAIR LONG
DOGS	GRAY	BLACK
	UNSPOTTED	SPOTTED
MAN	SKIN AND HAIR DARK	BLOND
	EYES DARK	EYES BLUE
	LIMBS SHORT	LIMBS LONG
	HAIR WAVY	HAIR STRAIGHT

AND HERE IS HOW IT ACTUALLY WORKS OUT, TAKING THE GUINEA-PIG AS ONE EXAMPLE....



BUT MENDEL DIDN'T REALIZE THE IMPORTANCE OF HIS WORK AND IN 1865, AFTER 8 YEARS OF EXPERIMENTS AND DISCOVERY, HE DECIDED TO QUIT...

I'll write up my experiments and devote ■ my time to the monastery!

UNFORTUNATELY, MENDEL WAS AHEAD OF HIS TIME. HIS REPORT WAS FORGOTTEN UNTIL 1900, WHEN WITH THE IMPROVEMENT OF THE MICROSCOPE AND NEW INTEREST ■ THE MYSTERY OF HEREDITY, SCIENTISTS WERE ASKING A VITAL QUESTION...

--WHAT PART OF PROTOPLASM CARRIES THE CHARACTERISTICS OF PARENTS TO OFFSPRINGS?

The controllers of heredity are those tiny bodies in the nucleus of all cells— the chromosomes!

So! My heredity is in my chromosomes! But how do they operate?

Within each chromosome are many smaller bodies, called GENES. Each one controls one characteristic, like eye color, tallness and so on!

I'd like to thank my genes for every similarity and difference I inherited from my ancesters!

True! The genes from each of your parents were mixed in the egg cell from which your body developed, and you probably resemble each one in some ways!

Here's a rare picture of the genes in ■ pair of chromosomes in the cells of a fly!

I see! Each gene controls the way in which a particular character of the fly will develop. How does it do it?

No one knows definitely. The behavior of genes is still being studied!

In the meantime, we'll go right on inheriting them, eh?

BUT UNLESS YOU ARE ONE OF IDENTICAL TWINS, THERE IS ONLY ONE CHANCE IN *TRILLIONS* THAT EVEN WITH THE SAME PARENTS THERE WOULD EVER BE BORN ANYONE IN THE WHOLE WIDE WORLD WHO WOULD BE— EXACTLY LIKE YOU!

THE STORY OF EVOLUTION

Links in the Chain of Life

IF YOU HAVE EVER BEEN TO THE ZOO TO WATCH THE ANIMALS....OR TO THE AQUARIUM TO SEE THE FISH....OR TO THE PARK TO LOOK AT THE PLANTS, YOU HAVE PROBABLY ASKED YOURSELF HOW SO MANY TOTALLY DIFFERENT KINDS OF PLANTS AND ANIMALS HAPPEN TO BE ON THE EARTH. LET'S LISTEN IN AS TOMMY ASKS THAT PUZZLING QUESTION, AND HIS TEACHER EXPLAINS...

IN TOMMY'S SCIENCE CLASSROOM...

Scientists believe, Tommy, that living things of all kinds come from different forms of past life in a long process of evolution.

You mean that this turtle and that rat developed from different forms of past life in a long process of evolution?

Yes—and scientists have collected a lot of evidence to prove their theory. For example, even rocks prove that the forms of life are always changing.

Rocks? I don't get it...

Our earth is a gigantic graveyard. It's tombstones are rocks — holding the preserved remains of plants and animals — called "fossils".

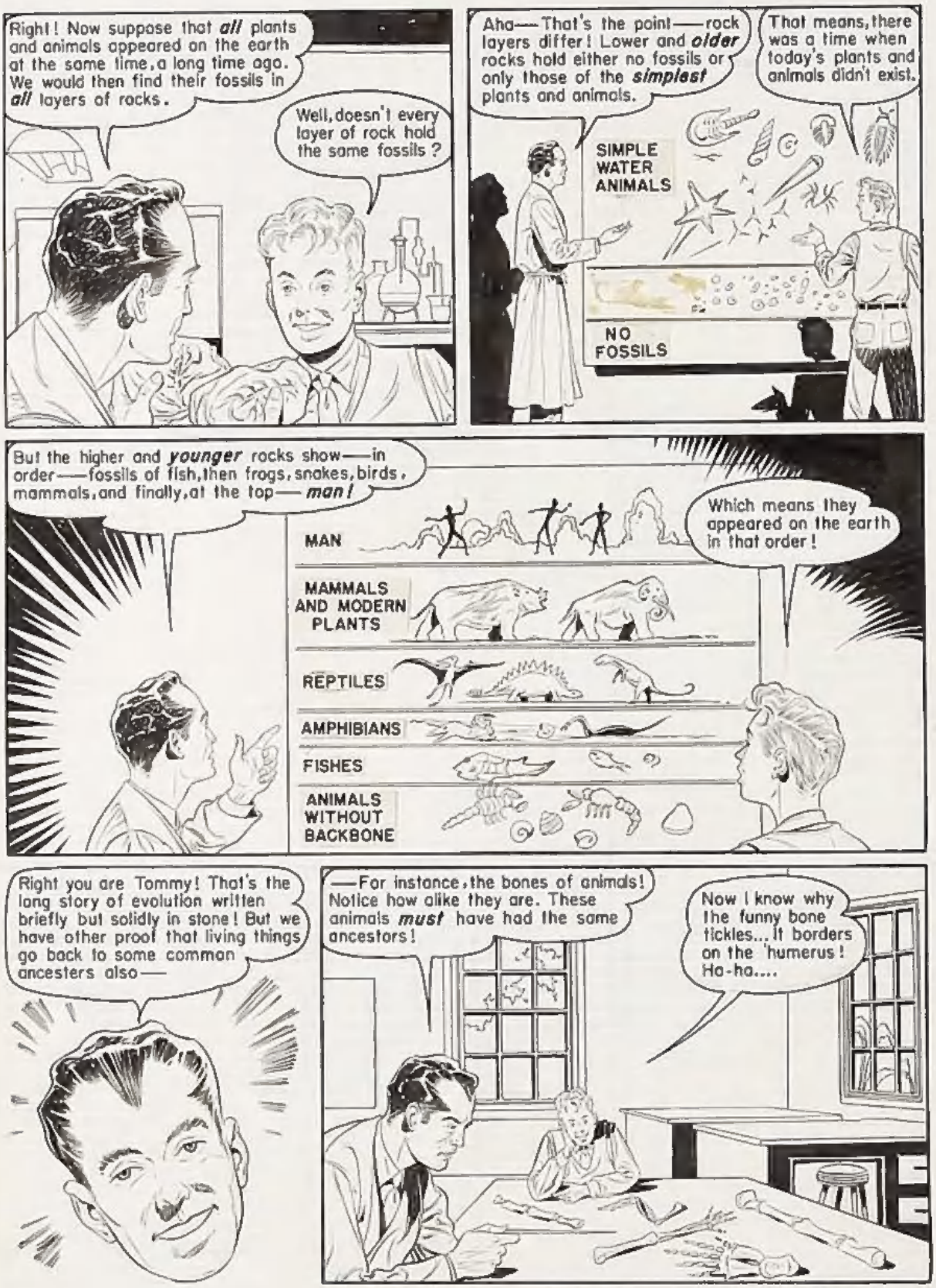
But where did the fossils come from?

Long ago, when a thing died, it fell into mud in which it made an impression that later hardened into stone.

But how do these fossils and rocks prove that living things keep on changing!

In this way...as the earth grew, rock settled on rock like dust settles on dust...

With the oldest rocks on the bottom and the newest rocks on top?


Right! Now suppose that *all* plants and animals appeared on the earth at the same time, a long time ago. We would then find their fossils in *all* layers of rocks.
Well, doesn't every layer of rock hold the same fossils?
Aha—That's the point—rock layers differ! Lower and *older* rocks hold either no fossils or only those of the *simplest* plants and animals.
That means, there was a time when today's plants and animals didn't exist.
SIMPLE WATER ANIMALS
NO FOSSILS
But the higher and *younger* rocks show—in order—fossils of fish, then frogs, snakes, birds, mammals, and finally, at the top—*man!*
Which means they appeared on the earth in that order!
MAN
MAMMALS AND MODERN PLANTS
REPTILES
AMPHIBIANS
FISHES
ANIMALS WITHOUT BACKBONE
Right you are Tommy! That's the long story of evolution written briefly but solidly in stone! But we have other proof that living things go back to some common ancesters also—
—For instance, the bones of animals! Notice how alike they are. These animals *must* have had the same ancestors!
Now I know why the funny bone tickles... It borders on the 'humerus! Ha-ha....

Hmmm — very funny! But do you know that between ***your*** bones and those of an ***ape***, there's a difference in proportion only — and that even your muscles correspond ?

Is there anymore proof of evolution ?

Yes! In the bodies of many animals are found traces of parts no longer used. They're called ***vestiges.*** Now — the animal ***must*** have passed through a stage when such a part was useful or it wouldn't have been there in the first place.

Animals keep on changing... In some animals the appendix is large and helps digest food.

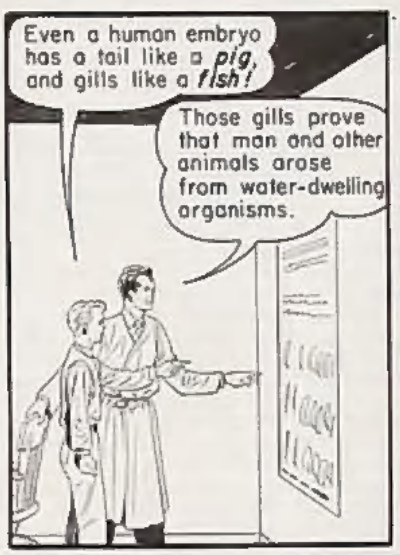
It's more than that — it's a nuisance !

The muscles in ***our*** ears are now useless, although the ear muscles in lower animals help them to hear by turning the ears toward the source of sound !

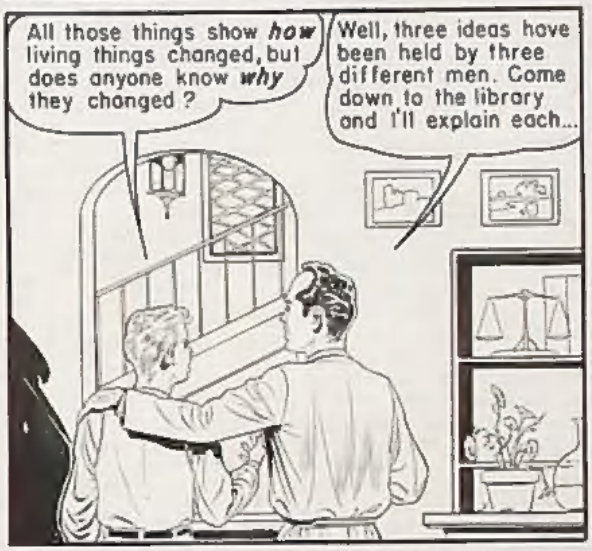
Gee ! Scientists sure are smart !

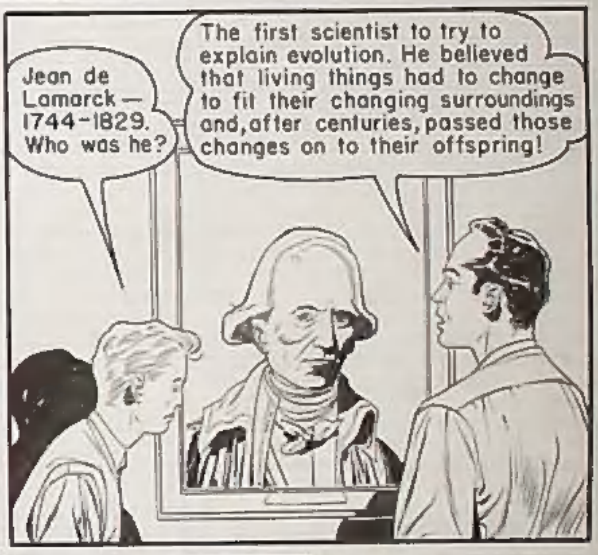
Yes, indeed ! They've also found that in many animals the early development of their offspring before birth — the ***embryos*** — shows very strong similarities.

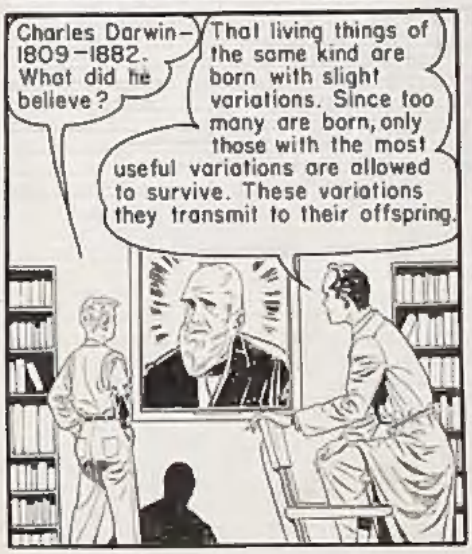
FISH SALAMANDER TORTOISE CHICK SHEEP PIG RABBIT HUMAN

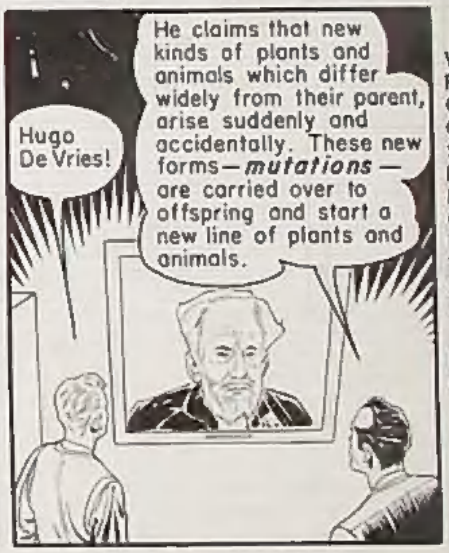
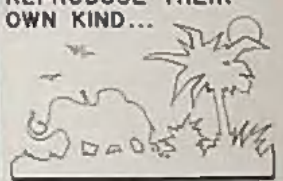

Even a human embryo has a tail like a *pig*, and gills like a *fish!*
Those gills prove that man and other animals arose from water-dwelling organisms.

Man's resemblance to apes is even more striking! Man was preceded by animals which resembled him and also the apes...like this "monkey-man" found in Java.
WOW!


All those things show *how* living things changed, but does anyone know *why* they changed?
Well, three ideas have been held by three different men. Come down to the library and I'll explain each...


Jean de Lamarck — 1744-1829. Who was he?
The first scientist to try to explain evolution. He believed that living things had to change to fit their changing surroundings and, after centuries, passed those changes on to their offspring!


Charles Darwin — 1809-1882. What did he believe?
That living things of the same kind are born with slight variations. Since too many are born, only those with the most useful variations are allowed to survive. These variations they transmit to their offspring.


Hugo De Vries!
He claims that new kinds of plants and animals which differ widely from their parent, arise suddenly and accidentally. These new forms — *mutations* — are carried over to offspring and start a new line of plants and animals.

REGARDLESS OF WHOSE IDEA IS CORRECT, THE SLOW PROCESS OF EVOLUTION GOES ON—BUT SO SLOWLY THAT IT IS PRACTICALLY UNNOTICED FROM ONE GENERATION TO THE NEXT. IN THE STORY THAT FOLLOWS, WE SHALL LEARN *HOW* AND *WHY* LIVING THINGS TEND TO REPRODUCE THEIR OWN KIND...